

**Assessment Annotations
for the Curriculum Frameworks**

Science

Grades 3, 7, and 10



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SCIENCE ASSESSMENT ANNOTATIONS

FOR THE

SCIENCE CURRICULUM FRAMEWORKS

The benchmark statements in the Science Curriculum Frameworks are at the second, fourth, eighth, and twelfth grades while the science portion of the Missouri Assessment Project will be given at the third, seventh, and tenth grades. In order to provide assistance in curriculum alignment to administrators, curriculum directors, and teachers concerning what is or is not “fair game” content for the science assessment, the attached document was developed by practicing classroom teachers and administrators.

This document includes the left-hand column (“What All Students Should Know”) and the center column (“What All Students Should Be Able To Do”) from the Science Curriculum Frameworks. The third column contains annotations about each benchmark as provided by several teacher work groups and is intended to provide guidance to **CTB/McGraw-Hill**, the assessment contractor. The first strand of the framework (Scientific Inquiry) was considered fair game at all grade levels and is not included in this document.

In the K-4 range, all of the benchmarks at grade two are “fair game” for assessment at grade 3. The benchmarks at grade four will have the words “Grade 3 state assessment” in the third column to denote a benchmark is “fair game” content or the words “Beyond grade 3 state assessment” to denote a benchmark that will not be considered at grade 3. Likewise, at the 5-8 range, the words “Grade 7 state assessment” or “Beyond grade 7 state assessment” will provide guidance. In the 9-12 range, the benchmarks will have annotations that say “Grade 10 state assessment” or “Beyond grade 10 state assessment.” Some of the annotations will be more specific and are self-explanatory. Not all benchmarks identified here as “fair game” for a state test will show up on the test in any given year.

Also, teacher work groups met in late **1996** and early 1997 to decide which of the seventy-three Show-Me Standards should be assessed on a statewide basis through the science performance assessment instrument. These teacher groups identified the following list of standards:

All of the Science Knowledge Standards

Performance Standards, Grade 3 :	1.3, 1.5, 1.6, 1.8, 1.10, 2.1, 3.5, 4.1
Performance Standards, Grades 7 & 10:	1.1, 1.3, 1.5, 1.6, 1.7, 1.10, 2.1, 3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7, 3.8, 4.1

These standards will be the focus of the performance event of the science portion of the Missouri Assessment Project.

III. MATTER AND ENERGY----ASSESSMENT NOTES

(Show-Me Standards, Science 1)

A. Characteristics, Forms, and Sources of Energy

B. Properties, Characteristics, and Structure of Matter

C. Interactions of Matter and Energy

K-12 content Overview:

The physical universe is composed of matter. Students must develop a basic understanding of nature, structure, and properties of matter. They should also experience and learn how matter is changed and how the uses of matter are related to its properties. Every physical object in the universe consists of relatively few types of matter called elements. Elements consist of unique kinds of atoms that combine in different ways to form substances. The arrangement of the outermost electrons in an atom determines how atoms bond to form materials. Each of the elements consists of only a few naturally occurring isotopes. Every substance can exist in a variety of different states, depending on temperature and pressure.

The flow of energy between objects, between different parts of the biosphere and from one part of the universe to another drives the continual process of change occurring throughout all physical systems (biological, chemical, geological). Society needs abundant energy sources to improve its economic productivity and the **chemical**, electrical, electromagnetic, mechanical, nuclear, and thermal, which are interchangeable. This transformation usually produces some heat energy that is lost by radiation or conduction. Whenever the amount of energy in one place or form diminishes, the amount in another place or form increases by an equivalent amount. Energy as well as matter occurs in discrete (quantum) units.

III Matter and Energy A. Properties, Characteristics, and Structure of Matter

What All Students Should Know	What All Students Should Be able To Do	Grade 3 Assessment Notes
<p><i>By the end of grade 2, all students should know that</i></p> <p>1. Observable properties are used to identify objects.</p>	<p><i>By the end of grade 2, all students should be able to</i></p> <p>a. identify physical properties of objects and sort according to specific properties. (1.3; 1.8; 4.1)</p> <p>b. identify physical properties of objects that are detected using the senses. (1.3; 2.4; 4.1)</p> <p>c. demonstrate that magnification enhances the ability to observe the properties of small objects. (1.4; 1.6; 2.1)</p>	Grade 3 state assessment
<p>2. Matter has physical properties that can change.</p>	<p>a. identify ways heat and light affect common objects. (1.3; 3.5)</p> <p>b. compare and contrast the physical properties of a solid and liquid of the same material. (1.2; 1.4; 1.6; 2.3)</p>	Grade 3 state assessment
<p>3. Mixtures are composed of different kinds of matter, each with distinct properties.</p>	<p>a. separate, sort, or group the components of a mixture by their properties. (1.3; 1.4; 1.6)</p>	Grade 3 state assessment
<p><i>By the end of grade 4, all students should know that</i></p> <p>4. Matter is anything that has mass and volume and is composed of smaller parts.</p>	<p><i>By the end of grade 4, all students should be able to</i></p> <p>a. select and classify a variety of common materials and objects as being composed of one substance or more than one substance. (1.2; 2.3; 3.5)</p> <p>b. refine and adapt the parts of objects to create a new object. (1.4; 1.6; 3.1; 4.6)</p>	Grade 3 state assessment

What All Students Should Know	What All Students Should Be able To Do	Grade 3 Assessment Notes
5. Substances can occur either in pure form or as a mixture.	a. predict the properties of a mixture given the concentration of ingredients. (1.6; 2.3; 3.5) b. identify the factors that determine the choice of materials for a particular purpose. (1.6; 2.3; 3.2; 3.3; 3.5)	Grade 3 state assessment
6. Physical properties of matter can change.	a. use magnifiers, measuring tools, and other technology to identify the properties of matter or objects. (1.2; 1.3; 1.7) b. select and apply strategies to change matter by heating or cooling. Predict what changes will occur. (1.3; 1.6; 2.4; 3.5) c. observe and describe the effects of the environment on a variety of objects (dissolving, weathering, shrinking, melting, rusting). (1.6; 2.1)	Grade 3 state assessment. Rulers okay but use cm units. Watch vapor as invisible gas. Avoid expansion/contraction.

III Matter and Energy B. Characteristics, Forms, and Sources of Energy

What All Students Should Know	What All Students Should Be Able To Do	Grade 3 Assessment Notes
<i>By the end of grade 2, all students should know that</i> 1. The sun is the primary source of light and heat for the Earth.	<i>By the end of grade 2, all students should be able to</i> a. predict how sunlight will affect the temperature of air and water. (1.2; 1.4; 1.6; 4.1)	Grade 3 state assessment
2. Energy can be converted into different forms	a. identify and describe the transformation of energy from one form to another. (1.2; 1.4; 3.5; 4.1)	Grade 3 state assessment
3. Sound is a form of energy that results from vibrations in matter. Sound has the qualities of pitch and loudness.	a. apply knowledge of sound, learned from altering loudness and pitch. (1.2; 1.3; 1.6)	Grade 3 state assessment

What All Students Should Know	What All Students Should Be Able To Do	Grade 3 Assessment Notes
<p><i>By the end of grade 4, all students should know that</i></p> <p>4. Some of the sun's light is transformed into heat when it hits objects.</p>	<p><i>By the end of grade 4, all students should be able to</i></p> <p>a. predict the effect of sunlight on various objects. Liquids, and solids. (1.6; 2.3; 3.5)</p>	Beyond grade 3 state assessment
<p>5. Electricity can be converted into light, heat, sound, magnetism, or mechanical motion.</p>	<p>a. apply knowledge of simple circuits to create a new circuit that involves more components. (1.10; 3.5; 4. 1)</p>	Beyond grade 3 state assessment
<p>6. Friction produces heat.</p>	<p>a. identify and consider a variety of methods that produce heat by friction (1.2; 1.3; 1.6; 3.5)</p>	Beyond grade 3 state assessment
<p>7. Sound travels at different rates through different materials.</p>	<p>a. select and apply technology and other resources to show that sound travels through some materials better than in others. (1.4; 2.3; 3.5; 4.6)</p>	Grade 3 state assessment
<p>8. Light spreads from a source and travels in straight lines. Light can be transmitted, reflected, refracted, or absorbed by different materials.</p>	<p>a. predict which materials will reflect, which will absorb, and which transmit light. (1.2; 1.6; 2.3; 3.1)</p> <p>b. use lenses or water to observe examples of the bending of light; use mirrors or a water surface to show how light is reflected. (1.6; 3.5)</p>	Beyond grade 3 state assessment

III Matter and Energy c. Interactions of Matter and Energy

What All Students Should Know	What All Students Should Be Able To Do	Grade 3 Assessment Notes
<p><i>By the end of grade 2, all students should know that</i></p> <p>1. Objects that give off light may also give off heat.</p>	<p><i>By the end of grade 2, all students should be able to</i></p> <p>a. identify and consider a variety of light sources to determine which give off heat. (1.1; 1.3; 1.6; 2.3; 3.5; 4.1)</p>	Grade 3 state assessment
<p>2. Heat causes materials to increase in temperature and feel warmer, or change state (gas, liquid, or solid).</p>	<p>a. select and apply strategies to show how heat causes materials to increase in temperature and makes it feel warmer. (1.2; 1.3; 1.6; 2.3; 3.5; 4.1)</p>	Grade 3 state assessment
<p><i>By the end of grade 4, all students should know that</i></p> <p>3. Warm objects lose heat to cooler ones until they reach the same temperature.</p>	<p><i>By the end of grade 4, all students should be able to</i></p> <p>a. identify which materials will become warmer and which materials will become cooler when mixed. (1.2; 1.6; 1.10)</p>	Beyond grade 3 state assessment
<p>4. Different types of matter conduct heat at different rates.</p>	<p>a. identify characteristics of conductive materials and of insulative materials. (1.2; 1.6, 1.10)</p>	Beyond grade 3 state assessment

III Matter and Energy A. Properties, Characteristics and Structure of Matter

What All Students Should Know	What All Students Should Be Able To Do	Grade 7 Assessment Notes
<p>By <i>the end of grade 8</i>, all students <i>should know that</i></p> <p>1. In a closed system, matter is conserved during any physical or chemical change.</p>	<p>By <i>the end of grade 8</i>, all students <i>should be able to</i></p> <p>a. use laboratory investigations to demonstrate the formation of new materials and demonstrate the conservation of matter. (1.3; 1.6; 2.4)</p>	Grade 7 state assessment
<p>2. Some physical properties depend on the amount of matter present while other properties do not.</p>	<p>a. identify those properties that are characteristic of a substance and those that depend on the amount of substance present. (1.2; 1.6; 1.8; 2.3; 3.2; 3.3)</p>	Grade 7 state assessment
<p>3. Almost all matter is derived from naturally occurring elements. Each element is made of atoms that bond together to form molecules.</p>	<p>a. investigate changes of state of water and use the particulate model to describe these changes. (1.1; 1.2; 1.3; 1.6; 1.7; 3.2; 3.3)</p>	Grade 7 state assessment
<p>4. The arrangement, motion, and interaction of molecules determine the physical state for the matter.</p>	<p>a. investigate property changes as a result of changes in the physical state of a substance. (1.1; 1.2; 1.3; 1.6; 1.7; 3.2; 3.3)</p> <p>b. investigate how the rate of change of state is affected by the addition or removal of heat. (1.1; 1.2; 1.3; 1.6; 1.7; 3.2; 3.3)</p>	Grade 7 state assessment
<p>5. Compounds can be analyzed and separated by making use of their unique chemical and physical properties.</p>	<p>a. separate natural or synthetic substances into their component compounds. (1.3; 1.4; 3.5; 4.6; 4.7)</p> <p>b. investigate and report why certain components of mixtures are reported to the public and how they are used to monitor health problems and/or environmental pollutants. (1.2; 1.3; 1.8; 2.1; 3.2; 3.3; 4.1)</p>	Grade 7 state assessment

What All Students Should Know	What All Students Should Be Able To Do	Grade 7 Assessment Notes
<i>By the end of grade 8, all students should know that</i>	<i>By the end of grade 8, all students should be able to</i>	
6. Chemical changes occur at the atomic level to form new substances with different properties.	a. identify chemical changes in common objects as a result of interactions with heat, light, air. (1.1; 1.6; 3.1; 3.5)	Grade 7 state assessment
7. Solution properties depend on concentration and nature of the substances involved.	a. identify the components of a solution, demonstrating the use of ratios and percents in preparing different concentrations of the solution, and compare the properties of different concentrations of the solution. (1.2; 1.6; 1.8; 3.1; 3.5)	Grade 7 state assessment

III Matter and Energy B. Characteristics, Forms, and Sources of Energy

What All Students Should Know	What All Students Should Be Able To Do	Grade 7 Assessment Notes
<i>By the end of grade 8, all students should know that</i>	<i>By the end of grade 8, all students should be able to</i>	
1. Most processes involve energy transformation with the release of heat. However, the total amount of energy remains constant.	a. measure and quantitatively compare the heat changes involved in an energy transformation. (1.2; 1.3; 1.6; 1.8; 2.4; 3.5)	Grade 7 state assessment
2. The electromagnetic spectrum consists of energy bands of visible and nonvisible wavelengths. White light from the sun consists of a mixture of wavelengths and energies in the visible part of the electromagnetic spectrum.	a. identify the wavelengths and energies in the visible part of the electromagnetic spectrum. (1.3; 1.6; 3.5) b. identify and discuss the use/misuse of the nonvisible part of the electromagnetic spectrum. (1.7; 1.10; 2.4; 3.8; 4.7)	Grade 7 state assessment
3. Electrical energy is transferred by the movement of electrons driven by a voltage through a complete circuit and is extremely useful to humankind.	a. understand the advantages and disadvantages of series and parallel circuits. (1.2; 1.3; 1.4; 1.6; 1.10; 3.7) b. compare various sources of energy for the generation of electric power. (1.10; 2.4; 3.8; 4.7)	Grade 7 state assessment

What All Students Should Know	What All Students Should Be able To Do	Grade 7 Assessment Notes
4. Static electricity is potential energy stored in a collection of separated negative and positive charges.	a. predict specific conditions that will cause static electricity. (1.2; 1.6; 2.4; 3.5) b. understand applications and hazards of static electricity. (1.10; 2.4; 3.8; 4.7)	Grade 7 state assessment
5. Chemical energy is stored in chemical bonds between atoms in the elements and compounds.	c. identify sources of chemical energy used in commercial and industrial activity and in life processes. (1.7; 1.10; 2.4; 3.8; 4.7)	Grade 7 state assessment

III Matter and Energy C. Interactions of Matter and Energy

What All Students Should Know	What All Students Should Be Able To Do	Grade 7 Assessment Notes
<i>By the end of grade 8, all students should know that</i>	<i>By the end of grade 8, all students should be able to</i>	
1. Energy is required to produce changes in matter and to do work.	a. design, conduct, and communicate about an investigation that shows the relationship between energy and changes in matter. (1.3; 1.6; 2.1; 2.7; 3.8)	Grade 7 state assessment
2. Heat energy can be transferred by conduction, convection, or radiation.	a. discuss the roles of radiation, convection, and conduction in weather changes. (1.2; 1.6; 2.3; 2.4; 3.5; 4.6)	Grade 7 state assessment
3. The interaction between matter and energy can result in changes in electronic, atomic, and molecular motion.	a. explain how an energy source interacts with and causes changes in different materials. (1.3; 2.1; 2.4; 3.5; 4.1)	Grade 7 state assessment
4. Different materials have different electrical resistance. Resistance converts electric energy into heat energy.	b. explain the characteristics of a substance that makes it a good conductor or insulator. (1.3; 2.1; 2.4; 3.5; 4.1)	Grade 7 state assessment
5. Energy travels through matter as waves.	c. identify waves as mechanical or electromagnetic and identify common wave properties. (1.2; 1.6; 1.7; 3.5)	Grade 7 state assessment

III Matter and Energy A. Properties, Characteristics, and Structures of Matter

What All Students Should Know	What All Students Should Be Able To Do	Grade 10 Assessment Notes
<p><i>By the end of grade 12, all students should know that</i></p> <p>1. The Periodic Table organizes the elements according to their physical properties and chemical reactivity.</p>	<p><i>By the end of grade 12, all students should be able to</i></p> <p>a. demonstrate how the Periodic Table can be used to predict the properties of elements and determine trends in these properties as they relate to the physical world. (1.6; 2.4; 4.1)</p>	Grade 10 state assessment
<p>2. Models can be used to represent elements, compounds, and ions.</p>	<p>a. describe the molecular, atomic, and ionic makeup of a variety of substances; use the appropriate formula to represent these substances; explain how the arrangement and motion of molecules determine a variety of biological, chemical, and physical phenomena. (1.6; 1.8; 2.2; 3.5)</p> <p>b. use bonding diagrams to show ionic and covalent bonding and to predict the outcome of a chemical reaction. (1.5; 1.8; 2.2; 3.5)</p>	Grade 10 state assessment
<p>3. Solution properties depend upon the concentrations, properties, and interactions of the solutes and solvents.</p>	<p>a. analyze and discuss the types and concentration of solute or solvent that affect the rate of solubility, acidity, viscosity of the solution. (1.3; 1.6; 1.8; 2.4; 3.2; 3.3; 4.1)</p>	Grade 10 state assessment
<p>4. The particulate model describes the electrically neutral atom.</p>	<p>a. describe the components of the modern model of an atom and how they are related. (1.4; 1.6; 2.4; 4.1)</p>	Grade 10 state assessment

III Matter and Energy B. Characteristics, Forms, and Sources of Energy

What All Students Should Know	What All Students Should Be Able To Do	Grade 10 Assessment Notes
<i>By the end of grade 12, all students should know that</i>	<i>By the end of grade 12, all students should be able to</i>	
1. Chemical and nuclear reactions provide energy that sustains industrial, life, and social processes.	a. conduct an investigation on how energy has been obtained/used and the consequences of its use. (1.1; 1.2; 1.3; 1.4; 1.6; 1.10; 3.8; 4.7; 1.9)	Grade 10 state assessment
2. The amount and rate of energy change for any process can be quantified.	a. determine the amount of heat required to change the temperature or state of a substance. (1.2; 11.3; 1.7; 2.7; 3.5)	Grade 10 state assessment
3. Energy can be transferred as waves. The frequency and wavelengths of the waves are affected by the relative motion of the source and receiver.	a. explain the Doppler Effect and identify some of its applications. (1.10; 2.4; 4.1)	Grade 10 state assessment
4. Voltage and resistance affect the flow of electric current in a circuit.	a. design an electrical circuit. (1.3; 2.3; 3.2; 3.3)	Beyond grade 10 state assessment

III Matter and Energy C. Interactions of Matter and Energy

What All Students Should Know	What All Students Should Be Able To Do	Grade 10 Assessment Notes
<i>By the end of grade 12, all students should know that</i>	<i>By the end of grade 12, all students should be able to</i>	
1. Chemical, physical, and nuclear changes involve energy transfers.	a. describe how energy is involved in chemical, physical, and nuclear changes. (1.6; 1.8; 2.1; 2.4; 3.5)	Grade 10 state assessment

What All Students Should Know	What All Students Should Be able To Do	Grade 10 Assessment Nntes
2. Heat flows from a body of a higher temperature to one of a lower one.	a. distinguish the direction of thermal energy in uatural processes. (1.3; 1.10; 3.5) b. investigate the relationship betweeu heat and work. (1.3; 1.4; 1.8; 2.1; 2.4; 3.5; 4.1)	Grade 10 state assessment
3. Phase changes can occur due to a quantitative transfer of heat energy.	a. iuvestigate phase changes that are induced by adding/subtracting heat euergy and explain, using the particulate model, how the interaction of atoms or molecules during a change of state affects the properties of the substance. (1.2; 1.3; 1.6; 2.1; 2.4; 3.5)	Grade 10 state assessment
4. The interaction of euergy and matter may result in the formation of heat or other energy forms.	a. describe the interaction of energy waves with the materials of marl-made devices. (1.3;1.6; 1 .10; 2.1; 2.4; 3.5; 4.1)	Grade 10 state assessment
5. Nuclear reactions can change matter iuto energy and vice versa. The total quantity of matter and energy is conserved .	a. analyze the amount of energy contained in the mass of substances. (1.2; 1.3; 1.6; 3.5; 4.1)	Grade 10 state assessment
5. Solar euergy travels through space, is distributed on Earth by radiation, conduction, or convection, aud powers atmospheric and oceanic circulation.	a. explain how the transfer of energy by air and ocean currents regulate the physical enviromment of the Earth . (1.2; 1.3; 2.1; 2.4; 3.3; 4.1)	Grade 10 state assessment